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Preliminary Report on the Molluscan Fauna of the Martin River Glacier and Associated Area

(South-Central Alaska)

BY

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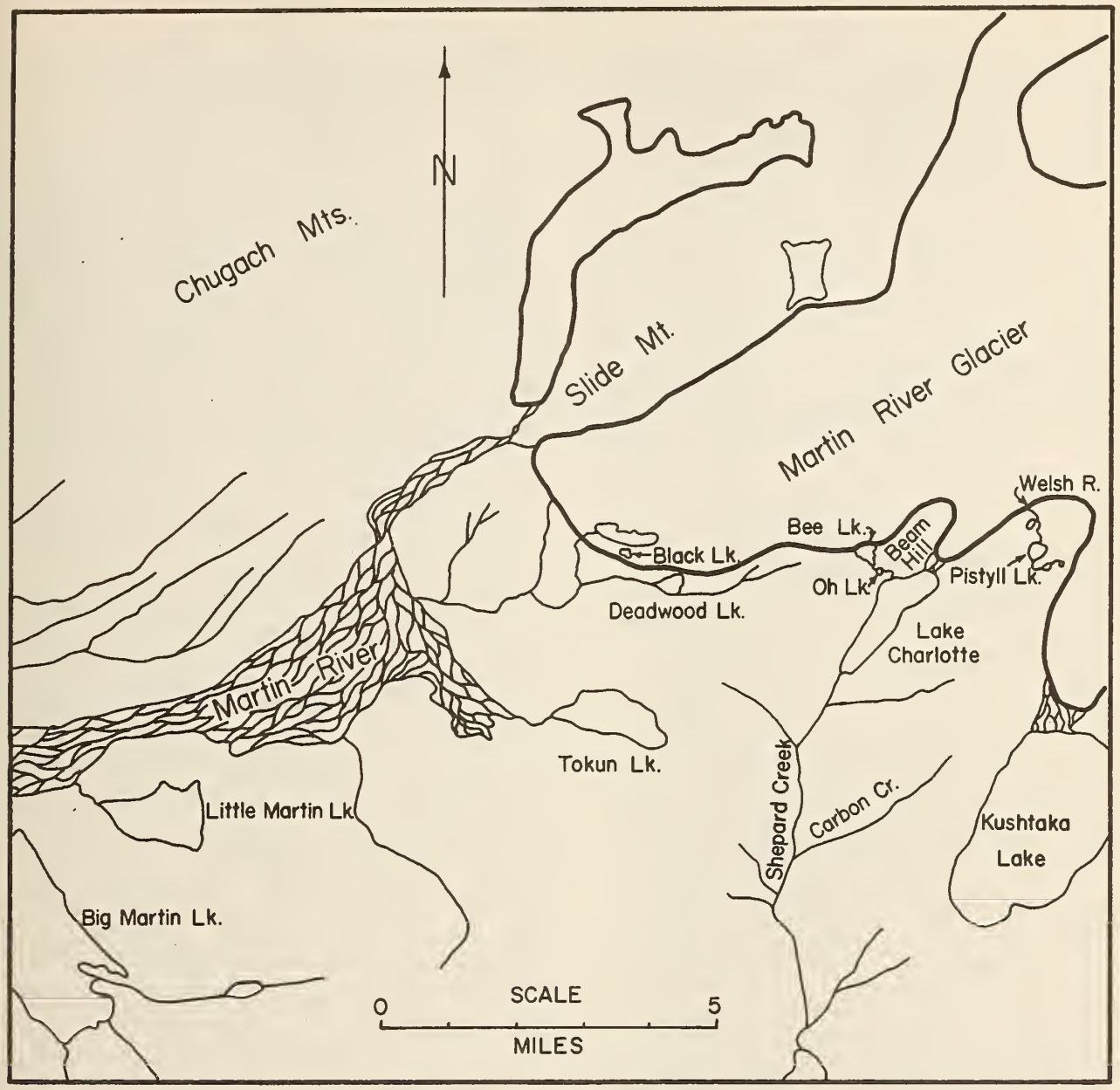
(1 Map)

During June, July, and August of 1962 a research team from the University of North Dakota, under the leadership of Dr. Wilson M. Laird, Professor of Geology and North Dakota State Geologist, studied several aspects of the Martin River Glacier which is located about 60 miles east-southeast of Cordova, Alaska (144° 22′30″ to 144° 00′ 00″ W. Longitude by 60° 34′ 30″ to 60° 25′ 00″ N. Latitude). Six species of terrestrial gastropods, 3 species of aquatic gastropods and one species of pelecypod were found on the glacier and in associated lakes. One additional species of gastropod and one additional species of pelecypod were found in lakes not directly associated with the glacier, but in rock basin lakes in the nearby area. The expedition was financed by grant number NSF-G22016 from the National Science Foundation. The study of the molluscan fauna was only a part of the overall research program.

This investigation is the first of its kind in the area of the Martin River Glacier and will be continued during the 1963 field season. The thermal and water chemistry data which were obtained in conjunction with the collection of mollusks are presented here. The results of the first season's research are summarized on Tables 1 and 2. The thermal data reported are taken from the locations at which mollusks were found and at the time of their collection and are not intended as an analysis of the thermal character of the lakes. The botanical associates of the terrestrial gastropods are also being studied.

The existence of aquatic mollusks in turbid meltwater lakes and terrestrial gastropods on the thin drift cover of the glacier itself is significant in that it clearly indicates the ability of some species of mollusks to adjust to unusual conditions and the danger of generalizing about ecologic controls near glaciers. The existence of an order of invasion of glaciated areas by mollusks is suggested by the early results of this investigation.

The use of fossil mollusks in reconstructing the climates which existed in the midcontinent during Pleistocene



SKETCH MAP OF THE

MARTIN RIVER GLACIER & THE ADJACENT AREA

LEGEND

Lakes

Rivers

Glacial boundary

Northeast corner of map at
144° W. Long. & 60°34'30" N. Lat.

LOCATION MAP

time prompted this study. Our results are not yet complete enough to warrant conclusions as to the validity of inferring climate from fossil mollusks, but they do suggest that the great adaptive capabilities and the environmental factors which may control geographic distribution of mollusks are not yet fully understood.

THE MARTIN RIVER GLACIER

The Martin River Glacier arises in the eastern Chugach Mountains, part of the St. Elias Range, emerges from these mountains and fills an east-northeast trending valley which is 4 to 6 miles wide (Fig. 1). It has a tripartite terminus with lobes extending into the valleys of Lake Charlotte, Kushtaka Lake and the Martin River. The main mass of the glacier occupies the Martin River Valley. Reconnaissance of the region indicates that the maximum Pleistocene expansion of the glacier did not extend beyond the southern shore of Kushtaka Lake, ¼ mile below Lake Charlotte, and the point where the Martin River is deflected by a moraine from its southwestern direction to a southerly direction (See fig. 1). A band approximately 1 to 1½ miles wide along the margin of the Martin River Glacier is covered by a dense growth of alder (*Alnus*).

Along the southern margin between Beam Hill and the Deadwood Lake area the glacier is covered by a mature Sitka Spruce (*Picea sitchensis* (Bong.) Carr.) forest which extends about ½ mile onto the glacier. The presence of dense growths of alder makes field operations very difficult in the entire area. A vegetative succession appears to exist. Lupin (*Lupinus Nootkatensis* Donn.) and fireweed (*Epilobium latifolium* Linné) first invade the drift covered portions of the glacier and are followed by alder, then willow (*Salix*) and finally Sitka Spruce. These observations are in agreement with those expressed by Heusser (1960, p. 51 to 52). The establishment of stable slopes by the accumulation of debris on the surface of the glacier seems to be a major controlling factor of the vegetational invasion. The amount of debris required to provide the necessary insulating effect to establish stable slopes is surprisingly small, being as little as 18 inches beneath the mature spruce forest near Deadwood Lake.

Unvegetated debris almost entirely covers the balance of the surface of the Martin River Glacier as far as 6 miles from the margin.

LAKES OF THE MARTIN RIVER GLACIER

The lakes of the Martin River Glacier can be divided into several different groups on the basis of the condition of their waters: polar-atrophic, temperate-oligotrophic, and temperate-mesotrophic. Or they may be divided on basin characters: ice-contact, ice-dammed, moraine dammed, and non-glacial. An informal classification is used here, which combines aspects of both of the above.

ICE-CONTACT LAKES

Sinkhole Lakes: The marginal 1½ miles of the Martin River Glacier contains many tens of lakes which are polar, atrophic, ice-contact water bodies. The temperature of the water rarely reached 3 ° C. The profiles of their basins are usually nearly conic and the basin itself is mostly an ice surface. Debris falls into these lakes and collects at the bottom, but has no insulating effect because the high turbidity of the water melting from the sides and flowing into the basins prevents light penetration below a few inches. A few insects and their larvae were the only organisms found in these lakes.

Ice-walled Clear Lakes: When the downward melting of the glacial terminus reaches a stage where the bottoms of the "sinkhole" lakes are not on ice, but on the subglacial surface or are otherwise stabilized, the accumulation of debris is sufficiently great to insulate the water from the ice walls of the basins. The development of stable slopes and forest cover near these lakes so impedes melting in the local area that turbid water rarely, if ever, enters the lakes. Over a period of years the suspended material completely settles out and the increased transparency of the water permits the warming of the lakes. Any inflow of water from melting ice is sufficiently filtered by the drift to remove most detrital material. Ice, deeply buried (at least 10 feet of drift being present in the area of Black Lake, fig. 1), still accounts for the basin and probably also the seal, but the water of the lake is effectively insulated from it. Black Lake is the only lake of this type from which water and sediment samples and mollusks have been taken so far, but upward of 20 such lakes are known to exist in the area north of Deadwood Lake. Beaver (*Castor canadensis* Linnaeus, 1758) and water fowl were observed, but no fish or other vertebrates were seen during the several hours spent on Black Lake. Three species of mollusks were found there (See Table 2).

ROCKBASIN MELT-WATER LAKES

Bee, Charlotte, and Oh Lakes are all temperate, turbid, oligotrophic water bodies. Three species of mollusks, Red Salmon (*Oncorhynchus nerka* (Walbaum, 1792)), Dolly Varden trout (*Salvelinus alpinus malma* (Walbaum, 1792)), Sculpin (*Cottus* sp.), beaver and water fowl were all observed in these lakes. Table 1 summarizes the water conditions. Bee Lake is dammed at its north end by the Martin River Glacier so that while having a rock basin in part, it represents a different situation than the other lakes mentioned. The epilimnion is thin but persists for more than a month in Bee and Charlotte Lakes. Oh Lake

receives its water from only the top 12 inches of Bee Lake and is of the same temperature as that stratum of the higher lake. It is not stratified, being approximately the same temperature from top to bottom.

NON-GLACIALLY ASSOCIATED LAKES

Tokun and Little Martin Lakes lie in basins which may have been occupied by a glacier during the Pleistocene. The portion of the basin along the valley of the Martin River may be fortified by glacial outwash deposits in the case of Martin Lake, and outwash or marginal moraine in the case of Tokun. I visited Tokun Lake for only an hour and did not visit Martin Lake at all. Mr. Rae Baxter, Biologist of the Alaska Department of Fish and Game collected 16 articulated valves of the naiad *Anodonta beringiana* MIDDENDORFF, 1851 from Big Martin Lake and was kind enough to give them to me. Three species of gastropods were found in Tokun Lake, one of which is a branchiate form. The lakes of the Welsh River area (Pistyll Lake, fig. 1; Table 1) do not receive melt water from the Martin River Glacier, but their basins are in depressions between moraines deposited by the glacier during times when the glacier occupied a greater area. The water of the lakes is temperate and clear. An abundant population of Dolly Varden trout exists in all of these lakes. The Welsh River flows subglacially for over 2 miles. Thus it seems that the trout made their entry into the drainage system at some time when the river flowed along the glacial margin or over the glacier. Two species of mollusks were found in the lakes of the Welsh River area.

Shores of Lake Charlotte:

Scientific Name	Common Name
Picea sitchensis (BONG.) CARR.	Sitka Spruce
Tsuga heterophylla (RAF.) SARG.	Hemlock
Coeloglossum viride (L.) HARTM.	Long-bracted Orchid
Limnorchis convallariaefolia (FISCH.) RYDB.	Orchid
Salix sp.	Willow
Alnus fruticosa RUPR.	Alaska Alder
A. fruticosa var. *sinuata* (REGEL) HUFF.	
Claytonia siberica L.	Siberian Spring Beauty
Caltha palustris L. var. *asarifolia* (DC) HULT.	
Aconitum delphinifolium DC	Delphinium-leaved Aconite
Cardamine umbellata GREENE	Umbel-flowered Bitter Cress
Tiarella trifoliata L.	Trifoliate Foamflower
Saxifraga spicata D. DON.	Spiked Saxifrage
Rubus pedatus SMITH	Five-leaved Bramble
R. spectabilis PURSH	Salmonberry
Geum macrophyllum WILLD.	Large-leaved Avens
G. calthifolium MENZ.	Caltha-leaved Avens
Sanguisorba sitchensis C. A. MEY.	
Lupinus nootkatensis DONN.	Nootka Lupine
Viola biflora L.	Two-flowered Violet
V. epipsila LEDEB. var. *repens* (TURZ.) W. BCKR.	Northern Marsh Violet
V. langsdorfii FISCH.	Alaska Violet
Epilobium latifolium L.	Dwarf Fireweed
Cornus canadensis L.	Bunchberry
C. unalaskensis LEDEB.	Bunchberry
C. suecica L.	Bunchberry
Pyrola asarifolia MICHX.	Liver-leaf Wintergreen
P. asarifolia var. *incarnata* DC	
Mimulus guttatus DC	
Erigeron yukonensis RYDB.	Daisy Fleabane
Anapholis margaritacea (L.) BENTH & HOOK	Pearly Everlasting
Arnica latifolium BONG.	

TABLE 1 WATER ANALYSES FROM SIX LAKES IN THE AREA OF THE MARTIN RIVER GLACIER, ALASKA

(The upper figure in each box is the mean, the middle is the number of samples analyzed, and the lowest is the range)

Water body	Dis. CO_2*	Dis. O_2	Cu	NO_3	SO_3	SO_4	Total CO_3**	Dis. SiO_2	Cl	Total Fe**	CO_4	Turb-idity	pH	Temperature at locality and time of collection of Mollusks (°C)	
Lake Charlotte	2.6	3.9	0	0	1.5	5.83	47.85	1.85	0	0.1	0	53.6	7.14	6/16-12.9	7/14-9.4
	4	4	1	2	2	3	3	2	2	2	2	11	11	6/20-6.8	7/19-10.2
	4.7	4.4	0	0	3	10.6	27	0.6	0	0.1	0	87	0.6	7/4-8.5	7/25-11.1
														7/9-8.0	8/3-9.4
															8/8-8.3
Bee Lake	2.1					0.1						55.6	7.2	7/30-6.5	
	7					1						7	7		
	2.1					0.1						23	0.2		
Oh Lake	3.5					1.0						68	7.2	7/30-9.6	
	1					1						1	1		
	0					0						0	0		
Pistyll Lake	4					3		3				0	7.7	7/28-12.8	
	1					1		1				1	1		
	0					0		0				0	0		
Black Lake	7.45		0	3.8	1.5	6.0	7.0	0	0	0.3	0	0	7.25	8/10-18.2	
	2		2	1	1	1	1	1	2	2	2	2	2		
	0.4		0	0	0	0	0	0	0	0.3	0	0	0.4		
Tokun Lake	2.8		0		1.5	3	40		0	0.2	0	0	7.2	8/10-14.2	
	1		1		1	1	1		1	1	1	1	1		
	0		0		0	0	0		0	0	0	0	0		

* The determination of water content was made with a Helige model 950-A colorimeter. Because of the difficulty of operations only partial analyses were made. All of the CO_2 determinations except those from Lake Charlotte and Black Lake were made on samples which were several hours old and may not be reliable.

** Includes suspended material

Vegetated portions of Martin River Glacier (at Charlotte lobe and near Black Lake):

Scientific Name	Common Name
Picea sitchensis (Bong.) Carr.	Sitka Spruce
Salix sp.	Willow
Alnus fruticosa Rupr.	Alaska Alder
A. fruticosa var. *sinuata* (Regel) Hult.	
Streptopus amplexifolius (L.) DC	Clasping Twisted Stalk
Cardamine umbellata Greene	Umbel-flowered Bitter Cress
Tiarella trifoliata L.	Trifoliate Foamflower
Rubus spectabilis Pursh	Salmonberry
Lupinus nootkatensis Donn.	Nootka Lupine
Epilobium latifolium L.	Dwarf Fireweed
Pyrola chlorantha Swartz	Greenish-flowered Wintergreen
Polemonium pulcherrimum Hook.	Jacob's Ladder

TERRESTRIAL ENVIRONMENT

Land snails were found along the shores of Lake Charlotte in grasses and other low vegetation, most frequently on peeled alder debris. They were also found under alders as far as ½ mile from the present terminus of the Lake Charlotte lobe of the glacier and on the shores of Black Lake. Table 2 shows the distribution of the species with regard to the glacier. The order suggested by this arrangement of data may be due to the small number of individuals collected. It is hoped that further study during the 1963 field season will clarify the question of whether an order of invasion of the glaciated area by mollusks actually exists. Temperature in the grass-covered outwash near the head of Lake Charlotte varied between 7° C and 35° C during the week of August 7 to 14. Temperatures reached as high as 38° C in the superglacial alder growths during July. Thus, despite the near proximity of ice, a temperate environment exists in which species of mollusks are maintaining successful populations.

The flora was unsystematically sampled at several locations during the course of the summer. Specimens were collected by the various members of the party, pressed in the field, and submitted to Dr. Vera Facey, Professor of Biology of the University of North Dakota for identification. The plants collected from locations from which land snails were collected are listed below. They represent only a small part of the flora known to exist in the area, but are given here as they are at least a part of the floral associates of the molluscan fauna. The taxonomic reference is Anderson, 1959.

FAUNAL LIST OF MOLLUSKS

Gastropods:

Menetus callioglyptus (Vanatta, 1895)
Gyraulus parvus (Say, 1817)
Lymnaea humilis (Say, 1822)
Valvata siberica Middendorff, 1851
Vertigo columbiana Sterki, 1892
Euconulus fulvus alaskensis Pilsbry, 1899
Vitrina alaskana Dall, 1905
Discus cronkhitei (Newcomb, 1865)
Punctum sp.
Deroceras laeve (Müller, 1774)
? *Prophysadon* sp.

Pelecypods:

Anodonta beringiana Middendorff, 1851
Pisidium sp.

ACKNOWLEDGMENTS

I am indebted to several people for assistance during the course of this investigation. Dr. Wilson M. Laird, Professor of Geology, University of North Dakota and North Dakota State Geologist and Mr. Lee Clayton, geologist, expended much time and effort in behalf of the limnological research, despite their primary responsibility to other aspects of the team's program of study. Mr. Rae Baxter, Biologist, Alaska Department of Fish and Game, offered valuable advice as well as actually collecting specimens in areas I was unable to visit. Dr. John Reid, Assistant Professor of Geology, University of North Dakota and Mr. Gerald McDonald, student assistant, helped pack equipment to two remote localities. Dr. Vera M. Facey, Professor of Biology, University of North Dakota, very kindly identified the plant specimens collected.

The people of Cordova, especially Mr. Karl Barth, Mr. James Osborne, Mr. Harley King and Mr. Ed King, were

Table 2

Geographic Distribution of Molluscan Fauna of the Martin River Glacier Area (S. C.) Alaska 1962

MOLLUSKS	LOCALITIES								
	Lake Charlotte & area	Bee Lake	Tokun Lake	Big Martin Lake	Black Lake & area	Lk. Charlotte lobe Martin R. Gl.	Oh Lake	Welsh Riv. area (Pistyll Lk.)	Totals
Aquatic Forms:									
Menetus callioglyptus	78	17	74	—	58	—	—	—	227
Lymnaea humilis	15	8	42	—	—	—	—	24	89
Gyraulus parvus	—	—	—	—	20	—	—	—	20
Valvata siberica	—	—	4	—	—	—	—	—	4
Anodonta beringiana	—	—	—	8	—	—	—	—	8
Pisidium sp.	—	—	—	—	2	—	X	17	19
Terrestrial Forms:									
Vertigo columbiana	42	22	—	—	4	28	—	—	96
Euconulus fulvus alaskensis	13	13	—	—	19	9	—	—	54
Vitrina alaskana	1	—	—	—	—	3	—	—	4
Discus cronkhitei	10	—	—	—	—	—	—	—	10
Punctum sp.	1	—	—	—	—	—	—	—	1
Deroceras laeve	—	—	2	—	—	—	—	—	2
? *Prophysadon* sp.	1	—	—	—	—	—	—	—	1
Total:	161	60	122	8	103	40	X	41	535
Times collected:	10	2	1	1	1	4	1	1	

most helpful to the party and I am grateful for their advice and assistance.

Dr. R. Tucker Abbott, Director of Mollusks, The Academy of Natural Sciences of Philadelphia, graciously permitted me to use the Academy's collections. This assisted me in identifying the mollusks collected and I am appreciative of his efforts.

Dr. G Dallas Hanna, Curator of Geology, and Mr. Allyn G. Smith, Associate Curator, Department of Invertebrate Zoology, California Academy of Science, criticized the manuscript and checked the identifications of the mollusks. I am very appreciative of their efforts in behalf of the study reported here, as well as the many courtesies extended to me personally by them.

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